May 7, 2009
COMMUNICATIONS PLAN

Indian Point Unit 2 Condensate Storage Tank Leak (CST)

NOTE: This is a limited communications plan intended to provide agency staff with information so the staff can respond effectively to internal and external stakeholders when questioned about the status of NRC follow-up actions with regard to the February 2009 CST pipe leak.

Key Messages

Feb. 16 Event Details:

- On February 16, 2009, Entergy confirmed indications of leakage, identified by an operator on a periodic plant tour, were from a buried section of piping associated with the Unit 2 CST return line. On February 21, 2009, Entergy personnel replaced the affected pipe section and declared the CST operable in accordance with their operating license.
- The leakage source was determined to be a 1.5" diameter hole in the buried section of pipe where the external protective coating was missing. Entergy sent the section of piping that was replaced to a laboratory for analysis to determine the failure mechanism.
- NRC inspectors determined that Entergy personnel identified the source of the leak, sampled the leak to confirm expected trace levels of tritium contamination, maintained the CST's availability to provide water to the auxiliary feedwater pumps not withstanding the leak, and replaced the pipe within the time frame required by the operating license.
- NRC inspectors assessed the environmental impacts of the leak and determined that the release was well below NRC regulatory limits for liquid effluents. For further perspective, even though the contents of the CST are not drinking water, the tritium concentration was well below the Environmental Protection Agency's drinking water limits.
- NRC inspectors will continue to observe and evaluate Entergy's follow-up actions to determine the causes of the pipe corrosion and identify other locations where such leakage could occur. We expect Entergy's evaluation to be available soon (late May 2009). The results of these reviews and inspections will be documented in NRC inspection reports that will be available to the public.
- ***(Broader buried piping message)*** The NRC is a learning organization and based on recent operating experience with buried piping, including this issue, we continue to review recent events for potential generic communication to the industry. The agency will also continue to review our inspection requirements and oversight processes to ensure our inspection approach appropriately considers the buried piping issues commensurate with their safety significance.

AFW key messages:

- The role of AFW is to supply water to the secondary side of the steam generators when the non-safety-related main feedwater system is not available. The water absorbs decay heat from the primary side of the plant and is converted to steam that is normally directed to the condenser.
- In the unlikely event that the three independent trains of AFW are not available for any reason, operators would implement their emergency procedures and initiate the cooling method using the Emergency Core Cooling System (ECCS), known as "feed-and-bleed" cooling. This involves only the primary loop. Operators are routinely trained and examined on their ability to implement emergency procedures including implementation of "Feed-and-Bleed" operations.

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Background:

On February 15 (~8:30 pm), during shift rounds, Entergy operators observed indications of water around a pipe penetration in the auxiliary feed pump building associated with an Indian Point Unit 2 condensate storage tank (CST) return line.

On February 16 (~1:30 am), Entergy determined there was condensate leakage in a buried section of piping associated with a condenser hotwell reject line to the CST. This section of piping is ASME class III 8" piping and is buried beneath the auxiliary feedwater pump (AFWP) building. Entergy determined that he majority of this leakage was being directed through the storm drain system (monitoring well 5) prior to flowing to the monitored IPEC discharge canal. The leakage sample obtained on February 15 confirmed hydrazine levels equivalent to what is expected for the water in the CST. Hydrazine is a chemical added to the condensate water to reduce dissolved oxygen and control the pH. The leakage was also determined to contain low levels of tritium estimated to be a small fraction of the EPA tritium drinking water limit.

Entergy excavated the area to gain access to the pipe to identify the leakage location and characterize the flaw. On February 21, 2009, Entergy personnel replaced the affected pipe section and declared the CST operable in accordance with their operating license.

Questions and Answers

Q1. What is the purpose of the CST and these underground pipes associated with the CST?

A1. The 600,000 gallon capacity CST works in concert with the condensate makeup and surge system portion of the main condensate and feedwater system to maintain normal water level in the main condenser hotwell. The main condenser takes the steam exhausted from the main turbine and converts it back to water for return to the steam generators in a closed cycle process. This condensed steam is collected in the hotwell portion of the condenser. Valves within the makeup and surge systems operate automatically in response to changes in water level in the hotwell to either draw water from the CST or discharge water to the CST to maintain the condenser water level within a prescribed range. These valves can also be operated manually.

During plant startup, a separate auxiliary feedwater (AFW) system is used. The main source of water for AFW is the CST. Additionally, in the event that the main feedwater system is inoperable, the auxiliary feedwater system supplies high-pressure feedwater to the steam generators to maintain a water inventory. This is needed to remove decay heat energy from the reactor coolant system (primary loop) by secondary-side steam (secondary loop). An isolating valve will close the condenser makeup before the condensate storage tank level reaches its Technical Specification minimum capacity. This will ensure a reserve of condensate for the auxiliary feedwater pumps that will hold the plant at hot shutdown for 24 hr following a trip at full power

The water in the CST is generally at ambient temperature and low pressure.

Q2. Did the pipe leak result in the CST not being available to perform its function?

A2. No. The leak was determined to be in the 8" return line to the CST. Design features, including an elevated return line with anti-siphon features within the CST would prevent a leak in the return line from draining the CST below the minimum required capacity. Additionally, the 12" line that supplies water to the feed system was not affected by this leak.

Q.3. What if the CST becomes unavailable?

A3. The auxiliary feedwater pumps can draw from an alternative supply of water to provide for long-term cooling. This alternative supply is from the on-site 1.5 million gallon city water storage tank which is independent of the CST and independent of any off-site local city water supplies. This supply is manually aligned by Indian Point operators to the auxiliary feedwater pumps in the event of unavailability of the condensate storage tank. No off-site support is required to align city water as a source of feedwater.

Q4. Does the NRC require periodic visual inspection of buried/inaccessible piping? If not, why?

A4. No. In accordance with NRC-issued operating licenses, licensees are required to comply with the applicable portions of the Code of Federal Regulations (CFR). 10 CFR 50.55a requires that licensees implement an in-service inspection program for pipes that complies with the standards of the ASME Boiler and Pressure Vessel Code. ASME Code Section XI provides requirements for the examination and testing associated with buried piping. The ASME Code for Class 3 piping requires a pressure-drop or flow test for buried piping. Licensees implement this and all ASME Code requirements through corporate and site-specific processes and procedures (e.g. ISI and IST program) that detail the necessary inspections and examinations to be conducted by licensee personnel to satisfy the ASME Code and NRC requirements.

The ASME Code Section XI requirements applicable to buried piping components are summarized below:

<u>IWA-5244</u> Buried Components - If isolable, do a leakage test that determines the pressure loss rate, or determine the change of flow between the pipe ends, or examine for evidence of leakage at the ends of the buried component.

<u>IWB-1220</u> Class 1 Components, General Requirements - piping 1" diameter (nominal) and smaller, and welds buried underground are exempt from examination.

<u>IWC-1220</u> Class 2 Components - most piping 4" diameter (nominal) and smaller and certain high pressure systems NPS 1-1/2" and smaller, and welds buried underground are exempt from examination.

<u>IWD-1220</u> Class 3 Components - most piping 4" diameter (nominal) and smaller and PWR Auxiliary Feedwater System NPS 1" and smaller, and welds buried underground are exempt from examination.

Note: Usually Class 1 piping is not buried underground and the few Class 2 piping components that are buried underground are stainless steel rather than more susceptible carbon steel.

A majority of the Class 3 buried piping components are in service water systems and have been addressed in NRC previous communication with the industry (eg. GL 89-13). In 2008, the nuclear industry initiated a program to address buried piping and components with a multifunction approach. Plants have numerous buried pipe systems that are not ASME Code Class 1, 2 or 3 and are not included in the scope of the ISI program required by ASME Code Section XI.

The NRC, in addition to requiring conformance with 10 CFR 50.55a for buried piping testing, requires that licensees implement a corrective action program to identify, evaluate, and correct adverse conditions commensurate with the safety significance of the issue. One example is the underground pipe leak experienced at Indian Point Unit 2 in February 2009. NRC inspectors will continue to observe, assess, and document Entergy's performance and follow-up actions to determine the causes of the pipe corrosion and identify other locations where such leakage could occur.

Q5. How does Indian Point implement the code requirements?

A5. Licensees implement ASME Code requirements invoked by 10 CFR 50.55a through corporate and site-specific processes and procedures (e.g. ISI and IST program) that detail the necessary inspections and examinations to be conducted by licensee personnel to satisfy the ASME Code and NRC requirements. Indian Point has procedures that periodically perform testing of the pipes to implement ASME Code requirements.

Q6. What NRC inspections have been done to independently verify that Indian Point is meeting code requirements?

A6. Except as documented in inspection reports or as necessary for on-going NRC inspection activities, the NRC would not typically request nor maintain licensee records to track licensee inspection performance in the area of buried piping. However, our search identified the following NRC inspection records that exist for Indian Point Units 2 and 3 and document inspections performed that, in part, included a review of buried piping since calendar year 1999:

NRC Inspection Report (IR) 2001-011 (ADAMS Ref. No. ML020240433, dated January 24, 2002): Documents NRC inspection review of testing related to suction piping of the auxiliary feedwater system. NRC inspectors identified a performance issue related to inadequate testing of auxiliary feedwater (AFW) buried suction piping from the CST in accordance with ASME Code and 10CFR50.55a(g)(4)(ii).

NRC IR 2001-014 (ADAMS Ref. No. ML020850420, dated March 26, 2002): Documents NRC inspection of an auxiliary feedwater system pressure-drop testing that verified the integrity of underground piping in accordance with the ASME Boiler and Pressure Vessel Code, Section XI. No performance issues associated with buried piping were identified.

NRC IR 2004-006 (ADAMS Ref. No. ML041770449, dated June 24, 2004): Documents NRC inspection of underground service water piping flow tests. No performance issues associated with buried piping were identified.

NRC IR 2007-006 (ADAMS Ref. No. ML071730036, dated June 20, 2007): Documents review of station fire header flow tests which supports verification of underground fire header piping integrity. No performance issues associated with buried piping were identified.

NRC IR 2007-004 (ADAMS Ref. No. ML073170147, dated November 9, 2007): Documents NRC review of several service water buried piping videos to ascertain piping integrity. No performance issues associated with buried piping were identified.

NRC IR 2007-004 (ADAMS Ref. No. ML073170091, dated November 9, 2007): Documents NRC review of underground auxiliary steam line leaks. No performance issues associated with buried piping were identified.

NRC IR 2007-005 (ADAMS Ref. No. ML080360454, dated February 5, 2008): Documents NRC review of service water large-bore piping inspections conducted every 10 years. Additionally, the report documents the inspectors' review of a number of video-recorded internal service water piping examinations. No performance issues associated with buried piping were identified.

NRC License Renewal IR 2008-006 (ADAMS Ref. No. ML082140149, dated August 1, 2008): Documents NRC's assessment of Entergy's buried piping inspection program, service water integrity program, and a review of buried piping inspection records. The report also documents a review of the AFW system, in particular, the management program that addressed buried piping inspections, corrosion, and external surfaces. No performance issues associated with buried piping were identified.

Additionally, NRC inspectors completed inspections of underground piping during the recent Indian Point Unit 3 Spring 2009 refueling outage. The inspectors reviewed the pressure decay test on the buried AFW suction piping from the CST and reviewed the results of internal piping inspections of select service water pipes. The inspection results are preliminary and will be documented in the second quarter 2009 inspection report expected to be issued in July 2009.

More broadly, inspection procedure, 71111.08, Inservice Inspection Activities, is performed during each refueling outage to assess the effectiveness of the licensee's program for monitoring degradation of vital system boundaries. The scope of the inspection is focused on the following safety-significant structures, systems, and components (SSCs): (1) Reactor coolant system pressure boundaries, including steam generator tubes in pressurized water reactors (PWRs). (2) Piping connected to the RCS, failure of which could result in an interfacing system loss of coolant accident. (3) Reactor vessel internals. (4) Risk-significant piping system boundaries. (5) Containment system boundaries (including coatings and post-tensioning systems, where applicable). Regional based specialists review a sample of nondestructive examination (NDE) activities to verify that: (a) NDE activities are performed in accordance with ASME Boiler and Pressure Vessel Code requirements. (b) Verify that indications and defects, if present, are dispositioned in accordance with the ASME Code or an NRC approved alternative (e.g. approved relief request). (c) Verify that relevant indications are compared to previous examinations to determine if any changes have occurred. The results of these inspections are documented in NRC inspection reports.

Q7. Has Indian Point determined the cause of the piping leak identified on February 16, 2009?

A7. Entergy determined that the leak developed in a 1.5" area where the external protective coating was missing. This section of piping was removed and sent to a laboratory for analysis to determine the cause of the corrosion. The result of this analysis is not yet available.

Q8. What type of piping was involved in this leak?

A8. The 8" pipe that developed the leak is schedule 40 carbon steel pipe, with a nominal wall thickness of 0.322 inches. The pipe was coated externally during construction with a tar-like coating known as "bitumastic." Bitumastic is a combination of asphalt and filler commonly used to coat metals to protect them against corrosion and weathering. It can be applied by spray, brush or roller.

Q9. What are the NRC's next steps?

Q9. NRC inspectors will continue to observe and evaluate Entergy's follow-up actions to determine the causes of the pipe corrosion and to identify other locations where such leakage could occur. The results of the reviews and inspections will be documented in NRC inspection reports that will be available to the public upon completion.

Q10. Entergy has applied to renew the licenses of Indian Point Units 2 and 3. What impact does this leak in buried piping have on the license renewal process?

A10. As part of license renewal, Entergy will implement a new aging management program that includes (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried tanks and piping. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components are inspected when excavated during maintenance. If trending within the corrective action program identifies susceptible locations, the areas with a history of corrosion problems are evaluated for the need for additional inspection, alternate coating, or replacement. Because Entergy now has operational experience, it should consider such experience when implementing the program, i.e., whether the scope and frequency of inspection should increase.

Q11. What is the requirement for nuclear plant operators to upgrade/replace their piping systems?

A11. The NRC does not mandate a prescriptive schedule for piping replacements, but rather requires licensees to do periodic inservice inspection of safety-related piping, vessels and welds per accepted industry codes and standards (i.e., ASME Section XI) for accessible piping. Licensees also do expanded inspections of piping on non-safety-related, secondary plant piping which may experience wall thinning or corrosion to predict future leaks and failures before they occur. Piping repairs or replacements are then done based on inspection results and erosion/corrosion projections.

The majority of nuclear power plant piping is original equipment because it is still in very good to excellent condition due to its initial robust design margin, controlled internal water chemistry (for closed systems), and, for buried piping, protective exterior (and, in some cases, interior) coatings. Some piping at stations was replaced long ago because it experienced erosion/corrosion, internal corrosion at pipe joints, or corrosion due to adverse water conditions (e.g., brackish service water). Inspection schedules/locations are typically adjusted based on past leaks, corrosion history, and inspection results.

For buried piping, some large diameter piping is inspected internally for corrosion where possible, or is subject to hydrostatic testing, where isolable, to identify leaks. Other piping is tested for integrity periodically by hydrostatic testing of piping sections where isolable, but is not examined visually. As part of licensees' aging management programs for license renewal, licensees have begun examining the coatings on select sections of underground piping to verify its integrity. Based on the extent of deterioration/corrosion found, as part of the licensees' Quality Assurance program, an evaluation is performed to determine the appropriate course of action. This may include repair or replacement of the affected piping, expanded scope of *inspection, and/or increase in inspection frequency.*

Q.12. What programs does the licensee have in place to assure the emergency cooling systems meet the design requirements of 10 CFR 50 Appendix A (GDC 44,45,46)?

A.12. The General Design Criteria (GDC) of 10 CFR 50 Appendix A were formally adopted in 1971 and have been used as guidance in reviewing new plant applications since then. The Commission determined, after staff review, that the GDC would not be applied to plants with construction permits issued prior to May 21, 1971. In a Staff Requirements Memorandum (SRM) dated September 18, 1992, the Commission wrote: "While compliance with the intent of the GDC is important, each plant licensed before the GDC were formally adopted was evaluated on a plant specific basis, determined to be safe, and licensed by the Commission. Furthermore, current regulatory processes are sufficient to ensure that plants continue to be safe and comply with the intent of the GDC." Because the construction permits for IP2 and IP3 were issued prior to May 21, 1971, they are not considered "GDC" plants.

In order to assure the emergency cooling systems meet the requirements of the licensing basis, there are several testing requirements that are the focus of NRC inspections. The most important surveillance requirements are listed in Appendix A to the plant license. Appendix A is referred to as Technical Specifications (TS). There are also inspections and tests required by 10 CFR 50.55a, to implement the ASME Code. The primary ASME Code programs are the inservice inspection program and the inservice test program. The NRC also periodically conducts targeted inspections to verify conformance with the design and licensing basis.

Q13. When was the last time the NRC inspectors conducted a visual inspection of the underground pipes at Indian Point and what was the results?

A13. During October 2008, the NRC observed and reviewed Entergy's inspection and ultrasonic testing of unearthed buried CST supply and return piping associated with two locations at different elevations (of approximately a 10 foot length) at Indian Point Unit 2. In addition to observing and reviewing Entergy's activities, the NRC visually observed the external portions of the exposed piping to independently assess its condition.